THE INSTITUTE OF PHYSICS
47 BELGRAVE SQUARE, LONDON, S.W.1.

BULLETIN

No. 58 OCTOBER, 1954

CONTENTS

	Page
Sir John Cockcroft, K.C.B., C.B.E., F.R.S., F.Inst.P. President 1954-1955 ...	193
Officers and Members of the Board, 1954-1955	194
Notices to Members	195
Physical Society Meetings	197
The Teaching of Applied Physics By J. Newton	198
Presentation of London Branch Gift	Plate II
Conference of Honorary Officers	Plate III
Appointments Vacant	ii

The Bulletin is not intended for general circulation : your copy should not therefore be passed to a library.

BOROUGH POLYTECHNIC, BOROUGH ROAD, S.E.1

A course of five lectures on Nucleonic Circuitry will be given by members of the staff of the Atomic Energy Establishment, Harwell. Lectures will be given on Wednesday evenings at 7 p.m. commencing October 20. Fee £1 10s. 0d. Syllabus and application form obtainable from the Secretary of the Polytechnic.

APPOINTMENTS VACANT

The inclusion of particulars of a vacancy must not be taken to imply that the Institute necessarily approves of the terms offered or that might be offered. Candidates should satisfy themselves that these are satisfactory, and they may always refer to the Institute for advice.

British Transport Commission, research department (railways) — a vacancy exists at **Derby** for a **scientific officer** Grade 1, salary range £778–£850.

Candidates must possess a good degree in physics, and should have had a wide experience in experimental physics. A knowledge of the industrial application of radioactive isotopes would be an advantage.

Superannuation and certain free travel facilities.

Applications to Director of Research (Railways), Staff Section, 222 Marylebone Road, London, N.W.1.

Large British Oil Company has vacancies for **geophysicists** on its exploration staff. Candidates should have an honours degree in physics with subsidiary mathematics and/or geology, but candidates with a general degree will be considered. The work involves delineation of underground rock structure by seismic, gravitational and magnetic techniques and offers considerable scope for men with initiative who are prepared to travel and to work abroad. Normal leave is four months after two years' foreign service.

When conditions permit, facilities are afforded for married men to have their families with them on foreign tours.

Basic salary is commensurate with age and experience, commencing at £820 for young, inexperienced graduates. Appropriate allowances are paid whilst on foreign service. Generous pension scheme.

Applications quoting F.107, should be addressed to Box 1223, c/o 191 Gresham House, E.C.2.

Versatile **assistant** with experience of electronic equipment required in research laboratory to join team studying hydraulics of diesel engine injection systems and servo governors. Most important qualification for this varied work is ability to complete details of design and construction of experimental apparatus and of the subsequent tests. Liability to National Service must be over. Salary according to qualifications and experience. Good opportunities for advancement. Pension scheme. Apply in writing to the Personnel Manager, R.6, **C.A.V. Limited,** Warple Way, Acton, W.3.

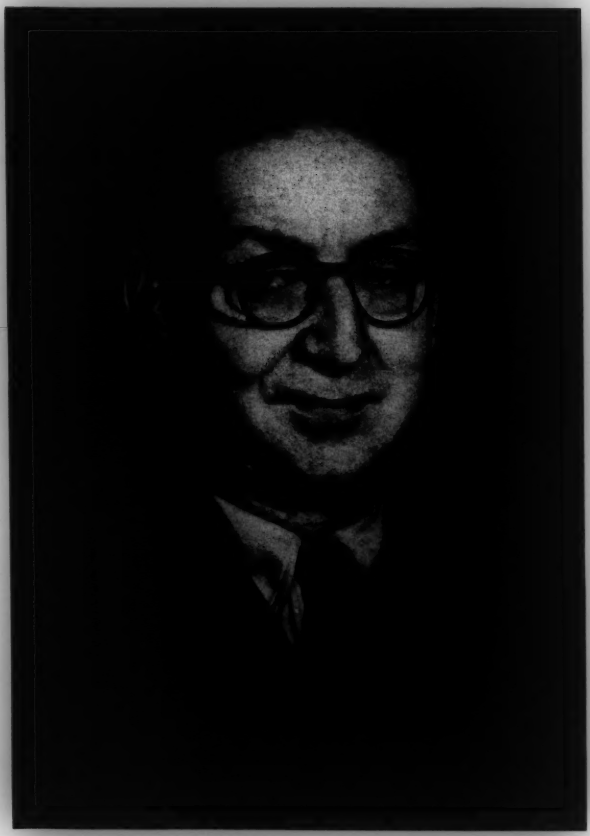
John Walton of Glossop Limited (a subsidiary of Tootal Limited) have a vacancy for a young executive on the production/development side, arising from the expansion of the Company's very modern finishing works. A graduate scientist or textile technologist aged not over 30 who has recently begun to apply his technical qualifications in the textile industry, especially in finishing, or a man of equivalent qualifications who has already had some years' practical experience in finishing are likely to have the best claims. It is intended that the appointment should be at Assistant Departmental Manager level and there are good opportunities for progress. Apply, giving details of age, education, qualifications and experience to the Personnel Manager, Tootal Broadhurst Lee Co. Ltd., 56 Oxford Street, Manchester, 1.

A **physical chemist** or **physicist** interested in the properties of matter and in physical chemistry, is required by leading oil company to work at their research centre in the Midlands. The applicant should be interested in industrial research and the subsequent application of research results in practice. The work is connected with the production of crude oil, and there will be good opportunities to proceed to technical posts in operating oilfields in various parts of the world. Applicants should have first or second class honours degree and be under 30 years of age. Good pension scheme. Salary according to age and experience. Write, stating age and full details of qualifications to Box 6985, c/o 191 Gresham House, London, E.C.2.

A leading Company in the Croydon area, specialists in industrial instruments and automatic control, has vacancies for **development engineer** and **technical assistants** for research and development work on a variety of applications in the electrical, optical and mechanical fields. An excellent fundamental knowledge of engineering principles and/or classical physics and a university degree are essential for the former, together with some practical experience in industrial control theory and practice. For the post of technical assistant a Higher National Certificate in mechanical or electrical engineering together with some practical knowledge in control mechanisms is required. Good salary offered to qualified man, with pension facilities. Please apply, stating age and qualifications, to Chief Engineer. Box A.V.67, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

(Continued on page iii)

PLATE I



SIR JOHN COCKCROFT, K.C.B., C.B.E., F.R.S., F.INST.P.

THE INSTITUTE OF PHYSICS

No. 58 BULLETIN October, 1954

SIR JOHN COCKCROFT, K.C.B., C.B.E., F.R.S., F.Inst.P.
President 1954–1955

Sir John Cockcroft who took office as President of the Institute on October 1, is well known not only among scientists all over the world but through his work as Director of the Atomic Energy Research Establishment at Harwell, his name is also known to the greater part of the general public.

Sir John was born in Todmorden, near the border of Lancashire and Yorkshire, in 1897, and received his school education there. After obtaining the M.Sc.(Tech.) degree of the University of Manchester and a Ph.D. of Cambridge he became a Fellow of St. John's College, Cambridge, in 1928. His work at Cambridge with E. T. S. Walton, for which they jointly received the Nobel prize in 1951, is particularly famed. In 1939 Sir John became Jacksonian Professor of Natural Philosophy in the University of Cambridge in succession to Sir Edward Appleton. He continued to occupy this Chair until 1946 but during those years was mainly engaged upon scientific work arising from the war. Sir John was Chief Superintendent of the Air Defence Research and Development Establishment of the Ministry of Supply, at Malvern, from 1941 until 1944 when he became Director of the Atomic Energy Division of the National Research Council of Canada. Two years later he became Director of the Atomic Energy Research Establishment of our own Ministry of Supply, a post which he still holds ; on the establishment recently of the United Kingdom Atomic Energy Authority, Sir John became one of the full-time members of this new independent body responsible for the development of the civilian uses of nuclear energy in this country. From 1952 until this year he also served as Chairman of the Government Defence Research Policy Committee and as Scientific Adviser to the Ministry of Defence.

Sir John was awarded the C.B.E. in 1944, was knighted in 1948 and created a K.C.B. last year. He was elected a Fellow of the Royal Society in 1936 and has received honorary doctorates from nine universities.

Joining the Institute in 1933, Sir John served on the Board from 1938 to 1946, the last two years as a Vice-President. He was the first chairman of the Electronics Group when this was founded in 1944.

OFFICERS AND MEMBERS OF THE BOARD 1954—1955

The new Board took office on October 1. Its members are as follows :—

President :

Sir John Cockcroft, K.C.B., C.B.E., F.R.S., F.Inst.P.

Immediate Past Presidents :

Prof. W. E. Curtis, D.Sc., A.R.C.S., F.R.S., F.Inst.P.
C. Sykes, D.Sc., F.R.S., F.Inst.P.

Vice-Presidents :

O. W. Humphreys, B.Sc., M.I.E.E., F.Inst.P.
T. L. Ibbs, M.C., D.Sc., F.Inst.P.
Prof. F. A. Vick, O.B.E., Ph.D., A.M.I.E.E., F.Inst.P.
G. R. Noakes, M.A., F.Inst.P.

Honorary Treasurer :

S. Whitehead, M.A., D.Sc., M.I.E.E., F.Inst.P.

Honorary Secretary :

B. P. Dudding, M.B.E., A.R.C.S., Ph.D., F.Inst.P.

Ordinary Members of the Board :

H. Barrell, D.Sc., A.R.C.S., F.Inst.P.
N. A. de Bruyne, M.A., Ph.D., F.Inst.P.
P. S. H. Henry, B.A., Ph.D., F.Inst.P.
K. A. G. Mendelssohn, M.A., D.Phil., F.R.S., F.Inst.P.
A. T. Pickles, O.B.E., M.A., F.Inst.P.
H. P. Rooksby, B.Sc., F.Inst.P.
W. H. Taylor, M.A., D.Sc., F.Inst.P.
R. G. Wood, M.Sc., A.M.I.E.E., F.Inst.P.

Chairman of Branches in Great Britain :

London and Home Counties Branch : J. S. Forrest, M.A., D.Sc., M.I.E.E., F.Inst.P.
Manchester and District Branch : W. J. Meredith, M.Sc., F.Inst.P.
Midland Branch : W. Betteridge, B.Sc., Ph.D., F.Inst.P.
North-Eastern Branch : (Vacant—see note below)
Scottish Branch : Prof. W. H. J. Childs, Ph.D., D.Sc., F.R.S.E., F.Inst.P.
South Wales Branch : R. G. Wood, M.Sc., A.M.I.E.E., F.Inst.P.
Yorkshire Branch : Prof. E. C. Stoner, B.A., Sc.D., F.R.S., F.Inst.P.

Nominated by the Physical Society :

A. B. Wood, O.B.E., D.Sc., F.Inst.P., C. G. Wynne, B.A., Ph.D., F.Inst.P.

At the last Board meeting of the previous session, held on July 20, a cordial vote of thanks to the retiring President Dr. C. Sykes was recorded. In proposing this Professor W. E. Curtis (Past President) spoke of the debt which the whole Institute owed to Dr. Sykes who had taken the keenest interest in all sides of the Institute's work during the two years of his presidency. Appreciation of the work of the other retiring members of the Board was also expressed. These are :— Dr. F. C. Toy, who has been a member of the Board as a Past President for the past four years ; Dr. J. Topping who has served on the Board since 1947, has been a Vice-President since 1951 and Chairman of the Membership Committee since 1949 ; Professor S. H. Piper who has served since 1951.

The death of Mr. H. G. Yates on September 15, 1954, is announced with regret. Mr. Yates served on the Board as Chairman of the North-Eastern Branch.

NOTICES TO MEMBERS

Bequest to the Institute

In the December 1953 issue of the *Bulletin* an announcement was made of benefits which the Institute might receive under the will of the late Mrs. Winifred Phillips, whose husband, the late Major Phillips, was one of the founders of the Institute. Through the sympathetic interest of Mr. G. L. Wates, one of the Executors, the Institute has already received a substantial proportion of its bequest, although the complicated business attendant on administering a rather involved Will is not yet complete.

The more substantial bequest was made to the Institute's Benevolent Fund, the Committee of which will have the right to nominate tenants to two flats in a south-eastern suburb of London. Mr. Wates has notified the impending availability of one of these flats. The Benevolent Fund Committee will meet early in November to consider proposals relating to the tenancy.

Notes for Authors

The Institute has just published a revised edition of its 32-page pamphlet *Notes on the preparation of contributions to the Institute's Journals and other publications*. It is intended to assist less-experienced authors

and to serve as a reference booklet for all who wish to contribute to the Institute's publications. The new edition gives hints on the preparation of a script and diagrams, on the lay-out of mathematics for the printer, the correction of proofs and so on. In addition to a short bibliography of reference books and works on technical writing, there are lists of the spellings, symbols and abbreviations used by the Institute. These have been modified a little in this new edition to conform with the new British Standard 1991, Part 1, 1954, *Letter symbols, signs and abbreviations*, Part 1, *General*, which authors of mathematical papers are also advised to consult.

Copies of the revised pamphlet may be obtained from the Institute for 2s. 6d. (including postage).

National Certificates in Applied Physics

The 1954 examinations for Ordinary and Higher National Certificates in Applied Physics had an increased number of candidates. In England and Wales there were 75 candidates for the Higher Certificate of whom 46 were successful. At the Ordinary level 206 candidates were presented ; 85 candidates qualified for the award of a certificate and 35 candidates passed the examination but were ineligible for certificates because they had completed only one year of the course. These latter candidates, who mainly hold General Certificates of Education with appropriate passes at the Advanced level, take the final year of the course for the Ordinary National Certificate with a view to qualifying for admission to the course leading to the Higher Certificate. Eighty-six Ordinary candidates failed to satisfy the examiners and the Joint Committee was disturbed to find that the proportion of failures at some of the colleges was more than 50 per cent of candidates presented. The Institute's assessors were Mr. G. W. Warren (Applied Physics), Mr. G. R. Noakes (Physics), and Dr. J. Topping (Mathematics).

In Scotland the number of candidates continues to be small but is increasing at the Ordinary level. Of the 2 candidates for the Higher Certificate one was successful, while 9 out of 14 candidates obtained the Ordinary Certificate. The Scottish assessor for all three subjects was Dr. G. Morris.

EXEMPTION FROM THE GRADUATESHIP EXAMINATION

Hitherto the possession of a Higher National Certificate in Applied Physics has entitled a candidate for the Institute's Graduateship Examination to exemption from all papers except two papers in Pure Physics. The Board of the Institute has decided to modify this concession by granting this exemption only to such candidates who obtain the Higher National Certificate at a " credit " standard.

The Board will be advised by the Institute's assessors of the extent of the exemption which should be granted to each successful candidate in the Certificate examination, and colleges will be notified of this exemption when they are notified officially of the results of the Higher National Certificate Examinations. In general, the present exemption will be given to candidates who have obtained not less than 50 per cent of the possible marks of the final assessed examination for the Higher National Certificate.

The new arrangement will come into effect at the 1955 examination for the Higher National Certificates. Candidates who have been awarded Higher National Certificates this year will all be given the maximum exemption (that is, from all papers except two papers in Pure Physics) except for a few caadidates whose certificates were awarded only after special consideration by the Joint Committee.

PHYSICAL SOCIETY MEETINGS

Members of the Institute are invited to attend any of the following meetings of the Physical Society and its groups :—

Date	*Title*	*Lecturer*	*Place*
Oct. 18, 5.30 p.m. Acoustics Group	Techniques for Objective Noise Measurement	Mr. N. Fleming	London : Imperial College
Oct. 21, 5.30 p.m. Low Temperature Group	The Physical Properties of Metals at Low Temperatures	Dr. N. P. Allen	London : Science Museum
Nov. 4, 2.30 p.m. Optical Group	The Application of Optics to Crime Detection	Mr. L. C. Nickells	London : Imperial College
	Microwave Interferometry	Dr. K. D. Froome	
Nov. 5, 5 p.m. Physical Society	The Development and use of large Radio Telescopes	Prof. A. C. B. Lovell	London : Royal Astronomical Society
	Some new Methods of Fast Photography (Charles Vernon Boys Lecture)	Dr. J. S. Courtney-Pratt	
Nov. 16, 5.30 p.m. Acoustics Group	Hearing Phenomena	Mr. I. A. Tumarkin	London : Imperial College

THE TEACHING OF APPLIED PHYSICS*

By J. NEWTON, B.Sc., A.Inst.P.
(*Northampton Polytechnic, London*)

AIMS

The courses for Ordinary and Higher National Certificates in Applied Physics are intended to give the student a thorough grounding in the fundamental principles of physics up to about Intermediate B.Sc. and General B.Sc. standard respectively. The courses include throughout sufficient training in mathematical techniques to provide the physicist with a suitable tool to be used, whenever appropriate, in the solution of physical problems. The student is also required to obtain a working knowledge of inorganic chemistry and an introduction to organic chemistry during the first two years of the Ordinary course. (In addition he receives a limited training in workshop practice and engineering drawing). I think few people will dispute that these subjects—physics, mathematics and chemistry—form the heart of the course. A man must be a physicist first and an applied physicist afterwards.

In the remainder of the time at our disposal we introduce—or treat more intensively than is normally done in a pure physics course of comparable standard—particular topics which we consider will be of use to the student in the particular industry in which he is engaged. We call these topics—applied physics.

The title of this talk should not be taken to imply that the methods of teaching applied physics and the difficulties encountered are in the main intrinsically different from those involved in the teaching of pure physics. Indeed it is difficult enough to make a clear distinction between the two branches even in drawing up a syllabus—and some people would argue that it is undesirable that we should try. For example, the principle of the Wheatstone bridge and potentiometer would normally be regarded as pure physics—do we move to the applied field when we use these principles in the measurement of resistance and e.m.f. in, say, a platinum resistance thermometer or thermocouple respectively ? Or again, where is the precise dividing line in thermodynamics between the pure physics and the application of thermodynamics to specific problems of engines, ejectors, refrigeration and so forth ? Conversely, what could be better pure physics than the theory of the cold cathode discharge ? And yet we probably deal with this in greatest detail in our lectures on electronics.

The latest official view—namely, that up to the Ordinary National Certificate level we should not separate the teaching of applied physics

* A paper read at a conference on National Certificates in Applied Physics held at the Institute's House on April 12, 1954.

from the teaching of pure physics—seems to me to be wholly commendable. At most, the attempt to split the subject matter into the two sections has only a propaganda value ! But if this represents the official view, surely to be logical we should no longer be required to submit separate syllabuses, and, even more important, to maintain the sub-division for examination purposes. Because we ourselves may have difficulty in sorting things out hardly excuses us from passing the problem on to the student.

At the Higher National Certificate level there is, I think, a sound case for keeping the teaching of applied physics separate from that of pure physics. We are here dealing with reasonably clear-cut topics such as high vacuum technique, electronics, spectroscopy, and so on. Notwithstanding the fact that much of our vacuum technique depends on it, I doubt whether it would be convenient in practice to treat the vacuum technique as an extension of the lectures on kinetic theory.

In so far, therefore, as we can distinguish special difficulties in the teaching of applied physics it seems that they will mainly arise at the Higher National Certificate level. My own experience has been limited to electronics and vacuum technique. My remarks will necessarily be based on that experience but I hope that they will be found applicable to other branches. I feel sure that many of them will be equally applicable to the teaching of pure physics.

APPLIED PHYSICS SYLLABUSES

Our first problem is the selection of the subject matter of the particular branch of applied physics with which we are concerned.

In this connection, may I make a plea for realistic syllabuses. In my opinion, confusion arises because we do not distinguish sufficiently clearly between an examination syllabus and a teaching syllabus. Both should exist, but which type should be submitted for approval and become available subsequently as the official syllabus for the course ?

To my mind the official syllabus should be an examination syllabus ; that is, it should contain only those topics which are to be regarded as examinable and which it is intended to cover thoroughly in the course. A teaching syllabus used for this purpose is misleading in that it is impossible to distinguish between those items which are of fundamental importance and which will be treated in detail, and those which will merely be mentioned in passing.

I have only had the opportunity of seeing a small number of syllabuses but I judge from them—and from our own experience—that the tendency is to fall somewhere between the two types. I suggest that the Notes for Guidance do not help here. The Ordinary National Certificate pure and applied physics syllabus, for example, mentions

explicitly many topics such as : reading of weather charts, testing strengths of materials, plasticity, viscometers, reverberation, auditoria, recording and reproducing sound, colour matching, development and fixing, principles of colour photography, colorimeters, saccharimeters, recorders, refrigeration, principle of steam engine, CO_2-recorders, electro-plating, gas-filled tubes, fluorescent tubes—to none of which I feel sure can we afford to devote more than a few moments. And it then asks us, to submit our syllabuses in more detail ! Might I suggest that all constructors of syllabuses should be expected to estimate the time required for the individual items and to fit them into the available hours—a most effective procedure for eliminating over-ambitious schemes of work.

Applied physics syllabuses should include those topics which may be classed as fundamental principles, and with which the student must be familiar if he is to have a firm foundation on which to build later. I venture to suggest that even though industry may feel the need for men with training in subjects which are not normally included in a pure physics course, it still remains true that in the long run, a man's usefulness depends more on a thorough understanding of fundamental principles than on a superficial knowledge of a wide variety of detailed techniques, circuit tricks and so forth.

Thus, in electronics for example, we should include a fairly detailed discussion of the physical processes occurring in the common electronic devices (high-vacuum and gas-filled valves, cathode-ray tubes, photocells, etc.). This should be followed by a description and detailed analysis of the behaviour of the basic circuits : rectifier, amplifier, oscillator. A thorough training in the design techniques of a limited number of circuits is more valuable than a superficial description of a wide variety of trick circuits.

This may seem to conflict with a requirement which is often stated ; namely, that our courses must be broad. But I think we sometimes overlook the fact that in a course of limited duration with students of a given calibre, breadth of syllabus is directly proportional to shallowness of treatment.

TEACHING

It is desirable that the teacher of applied physics should have a personal interest in, and enthusiasm for, his particular branch of the subject. If he also has a wide experience of it, in industry or research, so much the better. This may seem a truism but I think the point is worth making for it is more important here than in the teaching of pure physics, the subject-matter of which is fairly static, at any rate at the level with which we are here concerned. In applied physics, on the other hand, the subject matter often changes rapidly. For

example, vacuum technique has developed remarkably since the war years. Even though the theoretical basis—the kinetic theory—is still the same, the emphasis in our course will be different from that which was appropriate before. We now need to discuss the problems associated with large dynamic systems using high-speed pumps and high conductance tubing, all-metal demountable systems and the consequent need for much improved leak-finding devices. A considerable effort, involving much reading of the relevant books and journals supplemented by regular contacts with both the manufacturer and industrial user of vacuum equipment, is needed if the teacher is to keep abreast of developments.

It is also essential for a teacher to preserve a sense of proportion between the theoretical treatment of a topic and the more practical approach. The former can be acquired by reading but the latter can only come from personal experience and from contact with industry. As I have emphasized earlier, the theoretical approach leading to a clear understanding of fundamental principles is important but we must not ignore the fact that a good deal of industrial practice is essentially empirical, using the theoretical approach at most as a general guide to the procedure to be adopted. Unless we allow for this in our teaching of applied physics a student who is meeting the subject for the first time will be given a distorted outlook while the student who already possesses industrial experience will find our lectures remote from reality, and he may even suspect the extent of our own knowledge of the subject.

It may seem that the above remarks point towards the employment of specialist lecturers from industry. Specialist lecturers can undoubtedly contribute greatly to technical education and many technical colleges owe them a great debt. For the post-graduate (post-advanced) course requiring up-to-date knowledge of many specialized topics their help is essential. But we are hardly concerned with that here. In the Higher National Certificate—and even more in the Ordinary National Certificate—we are primarily concerned with teaching fundamental principles. In consequence the professional teacher with specialized interests is probably to be preferred to the external specialist, except for a very limited number of lectures concerned perhaps with local industry. There are without doubt exceptions to this statement, for often a man in industry is also a very good teacher and as such may be used to supplement, in a part-time capacity, the full-time staff of a college. But here we are employing him mainly because he is a good teacher rather than because he is a specialist.

There is little doubt that we do not always make the best use of exercises, especially at the Higher National Certificate level. At

Ordinary level we probably cannot do more than drill the students in the solution of certain stereotyped problems but in the Higher course it is undesirable to confine ourselves to routine exercises which involve little more than substitution in a formula. Even the poorer students often experience little difficulty with them, especially if they are obviously based on and set immediately after a given lecture, but it is a different story when they get to the examination.

We should aim at setting a considerable number of problems which call for the use of more imagination and the intelligent selection of the relevant theory taken from, say, a group of lectures. Thus, in electronics it is better to ask the student to design an amplifier to meet a specification rather than to give him the circuit and ask him to work out the gain, etc. No doubt we could arrange to supply him with data sheets and characteristic curves of a number of valves and let him select the most suitable for use in his circuit. It might then be worth considering whether he could wire up the circuit and test its performance. He would then be able to form an opinion as to the value of the theoretical approach to circuit design.

As an alternative we might from time to time ask the student to carry an analytical treatment of some problem a stage further than the point reached in the lecture, or apply a given theoretical treatment to a different problem from that already dealt with. It is desirable wherever possible to ask the student to discuss the practical significance of the theoretical result which he has reached.

Experience shows that the average National Certificate student finds great difficulty in dealing with the essay type of question which involves the selection of relevant information, its ordered presentation and possibly a critical discussion of various aspects of it. I think that we should give the student more practice in this, even at the expense of the more routine type of numerical exercise. It is in his interest, not only in the examination but in his job; for the ability to express oneself clearly is a quality well worth cultivating.

LABORATORY WORK

The expense and labour of equipping suitable laboratories is perhaps one of the greatest difficulties which has to be surmounted in the teaching of applied physics, although considerable strides have undoubtedly been made over the past few years.

In teaching basic principles much of our equipment need only be of an elementary nature. The most important requirements are robustness, ease of adjustment and, in certain cases, the ability to see how the equipment works—as, for example, with the student spectrometer. This type of equipment is probably adequate for the teaching of pure physics and for the applied physics up to about Ordinary level.

In the Higher National Certificate applied physics, however, it is desirable that the student should have the opportunity of handling a representative selection of industrial equipment. In some branches this raises serious difficulties in keeping up to date. For example, in our high vacuum laboratory the pumping stations have now reached their third edition although the laboratory was conceived only at the end of the war and came into service only in 1948. Not only has this required a fairly steady level of expenditure in the actual purchase of original equipment, but, even more important, it has entailed a very considerable effort in reconstruction on the part of the laboratory staff.

In other branches, for example X-rays and spectroscopy, the improvements in equipment and technique have probably not been so marked during the same period. On the other hand, the equipping of the laboratory entails a very heavy capital outlay, especially as there is less opportunity for the construction of equipment within the laboratory.

Finally, a word about the type of experiments which we ask the students to perform. In laboratory work in general we have the following objects :—

(*a*) To initiate the student into the methods of experimental physics and to train him in the art of writing a report on his work ;

(*b*) To teach him definite measuring procedures ;

(*c*) To support the lectures.

At the early stages of our course the emphasis is primarily on (*b*) and (*c*) and rightly so. Unfortunately the laboratory periods tend to degenerate into the carrying out of certain stereotyped experiments, with the aid of an instruction sheet. Perhaps this is unavoidable up to about Ordinary level but in the Higher course there is much to be said in favour of shifting the emphasis towards our first object by gradually moving from the routine experiment with its instruction sheets to more elaborate experiments, occupying perhaps three periods, in which the student is given only general instructions. We should realize that there is more scope for this type of experiment now that the externally assessed practical examination has been abandoned. I suggest that, in the light of this, we should do well to reconsider the laboratory work, particularly at the Higher National Certificate level.

There are undoubtedly difficulties to be overcome, chief of which is the limited time available in the course. More elaborate experiments or simple "investigations," mean fewer experiments. However, I think that we sometimes place too great an emphasis on the need for a student to work through so many of the standard experiments. Thus, in electronics we often ask him to plot the characteristics of a

considerable number of devices. Is this necessary ? He should do some undoubtedly, but at the Higher level it should be sufficient if the others are dealt with in the lectures.

The other main difficulty is in devizing experiments which will give the student a reasonable chance of reaching a conclusion in two or three periods. This is far from easy but it is not impossible. The following are some suggestions :

(i) Harmonic distortion in a triode and/or pentode. Theoretical calculation from characteristics drawn for the particular valve. Comparison with values measured using a wave analyzer. This could be combined with an exercise if desired.

(ii) Calculation and measurement of gain, frequency response, etc., of an amplifier. Effect of varying component values.

(iii) Effect of feedback on an amplifier. Gain, distortion, stability, input and output impedance.

(iv) Velocity of supersonics in nickel. This involves the theory of wave propagation, magnetostriction, pulse technique, use of high gain amplifiers and measurement of small time intervals. The latter can be done with a calibrated timebase or with a microsecond counter chronometer, which then involves the principle of scaling circuits.

(v) Degassing. Experiment arranged to simulate the processing of a valve ; baking, E.C.H. and gettering.

(vi) Blooming of glass in evaporating plant followed by the measurement of transmission by, say, Lummer—Brodhun, photo-emissive cell and photovoltaic cell.

(vii) Reverberation time. Practical measurement and theoretical calculation.

(viii) Young's modulus by optical interference method—bending of beam.

PRESENTATION OF LONDON BRANCH GIFT

During last session members of the London and Home Counties Branch were invited by the Branch Committee to make small contributions towards the cost of a gift of furniture to be presented to the Institute. It was decided that the gift should take the form of a specially designed mahogany table and lectern for the platform of the lecture room of the Institute's House. The presentation of these two beautifully made pieces was made by Dr. A. J. Maddock prior to the conference of Honorary Officers of Branches and Groups which was held on July 19 and reported in the September *Bulletin*. Dr. Maddock was Chairman of the Branch when the appeal for contributions was made. In the photograph reproduced above Dr. Maddock (on the right) is seen formally presenting the gift to Dr. J. Topping, Vice-President, who expressed the thanks of the Board on behalf of members of the Institute. On the left of the photograph is Dr. H. R. Lang, Secretary.

(*This photograph and those reproduced overleaf were taken by Dr. J. S. Forrest, present Chairman of the London and Home Counties Branch*).

PLATE III

CONFERENCE OF HONORARY OFFICERS OF BRANCHES AND GROUPS
July 19, 1954

These two photographs were taken on the balcony of the Institute's House before the conference of Honorary Officers of Branches and Groups. Above (*left to right*) are Dr. D. G. Drummond (*Hon. Sec., Manchester Branch*), Mr. R. G. Wood (*Chairman, S. Wales Branch*), Dr. N. Thorley (*Hon. Sec., North Eastern Branch*), Mr. G. W. Warren (*Chairman, Electronics Group*), Dr. J. Topping (*Vice-President ; Chairman, Education Group*). Below are four of the ladies who attended the luncheon preceding the conference. They are (*left to right*) Mrs. S. Rodda, Mrs. J. Topping, Mrs. N. Clarke and Mrs. J. S. Forrest.

Important printing organization has vacancy for an **assistant** to physicist in research department engaged on interesting new projects. The work will call for detailed knowledge and practical ability in process photography, printing-down on metal, and in etching, and for an aptitude in experimental work. Initially the post will be in London but later in a new factory now being built on the outskirts. Successful applicant eligible for permanent pensionable post. Starting salary of up to £850 according to qualifications and experience. Applicants should be British, aged about 30. Write stating age and full details of education, scientific and technical training, and appointments held to Box A.V.68, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Imperial Chemical Industries Limited, Billingham Division, has vacancies for **physicists** and **chemists** for both male and female Assistant Technical Officer posts in their Research Laboratories. Candidates should be not more than 27 years of age and should have at least an Inter-B.Sc. qualification. Salary will depend on qualifications and experience but as an indication a male candidate could expect eventually to rise to a salary of £730, £850 per annum, or, in special cases, an even higher figure. Write, giving brief details of career to the Staff Manager, Imperial Chemical Industries Limited, Billingham Division, Billingham, Co. Durham, quoting reference S.1.

The research and development division of **Baird & Tatlock (London) Ltd.** invite applications from **physicists,** preferably with honours degrees, for posts now vacant in the scientific instrument development laboratories. Applicants with or without experience of this class of work will be considered. Excellent prospects for those wishing to make a career in industry. Apply in writing giving full details of training and experience, if any, and stating age and salary required to 14/17 St. Cross Street, Hatton Garden, London, E.C.1.

Physicists required with honours degree in physics and some industrial experience to join the research staff to work on application of research techniques to problems connected with flour milling engineering, process engineering and allied subjects. A wide variety of projects are in course of development and good scope exists for people showing ability and initiative. **Henry Simon Ltd.,** Simon Engineering Group, Cheadle Heath, Stockport.

Assistant with interest in properties of matter, required for research on behaviour of packaging materials under shock. A familiarity with electronic circuits useful. G.C.E. Advanced level in physics and mathematics preferably with laboratory experience £275–£475. Male applicants should have completed or be exempt from National Service. Application forms from Secretary, **Printing, Packaging and Allied Trades Research Association,** Randalls Road, Leatherhead, Surrey.

Hammersmith Hospital and Postgraduate Medical School
Du Cane Road, London, W.12

Physics laboratory technician with experience lathe, workshop practice, a.c. electricity, physics laboratory apparatus. Knowledge of X-ray equipment desirable. Salary scale £470–£545.

Age, education, qualifications, experience and the names of two referees to the Secretary of the hospital.

Messrs. Barr & Stroud Ltd., Anniesland, Glasgow, require the services of one or two young men, preferably with a university degree in engineering or physics and with some industrial experience.

Applicants must have a sound technical and scientific education such as would be required to carry out research and development work associated with scientific instruments of a wide variety.

The work is interesting and offers scope to men of outstanding ability.

Applications should contain full particulars including age, nationality, school and college education, industrial experience, also salary required. Replies should be addressed to the Secretary.

The British Rubber Producers Research Association invite applications for an appointment as a **technical assistant** at their laboratories at Welwyn Garden City. The work will largely be associated with the physical testing of rubber and will involve the development and design of machines and methods of testing.

Applicants should have at least General Certificate of Education at advanced level in science subjects or equivalent, and preferably, previous experience in laboratory work.

The appointment will be according to qualifications and experience. The salary range £300–£500 + 10% cost of living bonus + children's allowances where applicable. Housing accommodation may be made available to married applicant.

An **honours graduate,** male, up to 27 years of age is required in the research laboratories for work on the physical processes involved in the manufacture of thermoplastic materials. Previous experience with plastics is not essential, but candidates should have interests in the fields of mechanical and rheological properties of materials. Write giving full details, Research Director, B.X. Plastics Limited, Lawford Place, Nr. Manningtree, Essex.

Ministry of Supply, Radar Research Establishment, Malvern, Worcs., requires **principal scientific officer** or **senior scientific officer** to work on design and construction of millimetre wave magnetrons and other microwave valves, involving fundamental research into processes occurring in such valves and solution of technological problems on construction. Qualifications 1st or 2nd class honours degree or equivalent qualification in physics, engineering or mathematics. Experience in field of microwave valves is essential. Salary within range P.S.O. (minimum age 31 years) £1090–£1472, S.S.O. (minimum age normally 26 years) £935–£1090. Women somewhat less. F.S.S.U. benefits may be available. Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting A 247/54A. Closing date October 23, 1954.

Kingston upon Hull Education Authority Municipal Technical College

Principal: Emlyn Jones, M.Sc., F.R.I.C.

Required as soon as possible **teacher** (Assistant, Grade B) for **physics** to final B.Sc. standard and to assist in the development of post-graduate short courses in applied physics. Candidates should have a good honours degree. Experience in some branch of applied physics is desirable.

Salary: £525 × £25 – £620 (plus additions for training and/or graduate qualifications).

Further particulars and application forms, to be returned within fourteen days of the date of this issue, will be supplied by the Chief Education Officer, Guildhall, Kingston upon Hull.

(*Continued on page iv*)

Research physicist required for fundamental research work in a large industrial Company. Candidates should have a good honours degree, preferably with some research experience in solid state physics or semi conductor field. The successful applicant will be responsible for a long-term investigation of the electrical properties of polyamides to include a.f. and r.f. dielectric measurements; basic mechanism of conductivity and theory of static electrification. Box A.V. 69, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

University of Hong Kong. Applications are invited for the vacant post of **senior lecturer in physics.**

Emoluments (for a single man) on expatriate terms are as follows: £1405 × £40 – £1565 per annum. (A family allowance and a variable and temporary High Cost of Living Allowance are paid as applicable).

Applicants should be graduates of British Universities and have appropriate qualifications and experience, and should be prepared to take up the post not later than April 30, 1955.

First class sea passages are provided for expatriate staff.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications in Hong Kong and London, is November 30, 1954.

T. I. (Group Services) Limited have a vacancy for an **electronics engineer** in the development and research department for work on the application of electronic techniques in measurement and control in industry. Applicants must have a good degree and should have had some experience in a research or development organization. Applicants should also have completed or be exempt from National Service. Age 23–30. Salary, £500–£800 per annum, depending upon qualifications and experience. The post is permanent and pensionable. Apply in writing to W. B. Jones, Esq., T. I. (Group Services) Limited, Plume Street, Aston, Birmingham, 6.

British Rayon Research Association. Physicist required to undertake research on the shrinkage and dimensional stability of fabrics. Applicants should have a good honours degree, and some research experience is desirable. Age under 30 preferred. Superannuation under F.S.S.U. Applications, with two recent testimonials, or the names of two referees, should be sent to the Secretary, British Rayon Research Association, Heald Green Laboratories, Wythenshawe, Manchester.

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